

A graph of $\log k_{ga}$ against $\log F_A$ is plotted and the gradient is compared with the literature value of 0.83.

2.Experimental Equipment

The experiment was conducted using several apparatus. The apparatus consisted of an ammonia absorption packed column and absorption train used to measure the ammonia concentration in the air. The apparatus also consists of titration equipment used to calculate the quantity of ammonia absorbed. In order to determine the effect of flowrate on mass transfer coefficient, water containing absorbed ammonia and sulphuric acid containing absorbed ammonia had to be collected, observed, and then titrated and back-titrated. The various different measurements that were controlled and recorded during the experiment consist of time, water-flow rate, airflow rate, and absorption. The numbers labelled 1-14 on figure 1 (shown below) represents the different instruments and parts that an ammonia absorption packed column system unit is made up of. The numbers labelled 1-10 on figure 2 (shown below) represents the different instruments and parts that a titration unit is made up of.

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Page 6 of 17

When the water-flow rate has been set, water enters the top of the packed column and flows down through the packing before exiting the bottom of the column and being drained. When the airflow rate has been set, air bubbles through the conical flask containing the concentrated solution of ammonia. The air then passes through the bottom of the packed column where most of the ammonia is absorbed but some escapes through the top. From the top of the column the air passes through to the absorption train, which is accessed through the open three-way valve. The ammonia then passes into bottle 1 and 2, and when it is present the indicator in bottle 1 changes colour and the experiment is stopped. During the experiment while the test stabilises, the three-way valve is turned to direct the air leaving the top of the column to the safety bottle containing diluted sulphuric acid. This is to remove and unabsorbed ammonia. At the end of the experiment the drained water containing absorbed water, and bottle 1 and 2 are collected.

The experiment also consists of a titration unit containing two burettes. The first burette is used to back-titre the collected sample from bottle 1 and bottle 2 using 0.01 N of sodium hydroxide. The second burette is used to titrate the collected sample of water containing absorbed ammonia with 0.01 N sulphuric acid. Before titrating both samples a pH buffer is added to the samples so that a colour change can be observed. A volumetric pipette is used to choose the desired volume of the sample.

3.Experimental Procedure

Before carrying out the experiment it was advised that both safety goggles and protective gloves should be worn. This was because the provided stock solution of sulphuric acid is a potential irritant and also highly flammable.

A dummy run was completed before the experiment was conducted in order to become familiar with the analytic procedures. In this dummy run no water was passed down the packed column and the air was set at a flowrate of 4 L/min.

Test 1:

1. Firstly the water flowrate was set at 1.0 L/min and allowed to run for approximately 10 minutes in order to ensure that the packing within the packed column is fully wetted.
2. Before carrying out the test, 25ml of 0.01 N sulphuric acid was collected. Using a volumetric pipette the 25ml of sulphuric acid was split into 20ml and 5ml and placed in separate absorption bottles.
3. The two bottles were then filled with distilled water until the total amount of liquid in each bottle equalled 50ml to ensure adequate bubbling. Approximately 6-7 drops of phenolphthalein was then added to each flask, before the bottles were placed in the absorption train. The 5ml bottle was placed closest to the column.
4. Once the water had run for 10minutes and the bottles had been placed in the absorption train, the air flowrate was set at 14 L/min.
5. When the conditions had stabilised, the three-way valve was turned to shut off the dilute sulphuric acid bottle and direct the air through the ammonia absorption train. The clock was started the same time as the valve was turned.